# UNITED STATES PATENT AND TRADEMARK OFFICE

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/894,627 | 06/28/2001 | John T. Boland | 82531DMW | 6130 |

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| EXAMINER |
|---|
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| ART UNIT | PAPER NUMBER |
|---|---|
| 2623 | |

DATE MAILED: 05/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

|  | Application No. | Applicant(s) |
|---|---|---|
| **Office Action Summary** | 09/894,627 | BOLAND ET AL. |
|  | Examiner | Art Unit |  |
|  | Wes Tucker | 2623 |  |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on _18 October 2004_.
2a)☐ This action is **FINAL**.　　2b)☒ This action is non-final.
3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) _1-17_ is/are pending in the application.
　　4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5)☐ Claim(s) _____ is/are allowed.
6)☒ Claim(s) _1-17_ is/are rejected.
7)☐ Claim(s) _____ is/are objected to.
8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.
10)☒ The drawing(s) filed on _16 August 2001_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.
　　Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
　　Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
　　a)☐ All　b)☐ Some * c)☐ None of:
　　　1.☐ Certified copies of the priority documents have been received.
　　　2.☐ Certified copies of the priority documents have been received in Application No. _____.
　　　3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
　　* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1)☒ Notice of References Cited (PTO-892)
2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3)☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
　　Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
　　Paper No(s)/Mail Date. _____ .
5)☐ Notice of Informal Patent Application (PTO-152)
6)☐ Other: _____.

## DETAILED ACTION

### *Response to Arguments*

1.      Applicant's response to the last Office Action, filed October 18, 2004 has

been entered and made of record.

2.      Applicant has amended claims 3 and 6.  Applicant has added new claims

16 and 17.  Claims 1-17 are pending.

3.      Applicant's arguments, filed October 18, 2004, with respect to the

rejection(s)of claim(s) 1-15 have been fully considered and are persuasive.  However a

new rejection is applied in view of the new reference of U.S. Patent 6,512,994 to

Sachdeva.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that

form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-4, 7-12, and 14-16 are rejected under 35 U.S.C. 102(e) as being

anticipated by U.S. Patent 6,512,994 to Sachdeva.

With regard to claim 1, Sachdeva discloses a method for creating a dental model from a series of images of an intra-oral object, said method comprising the steps of

a) capturing a series of images of an intra-oral object from a plurality of capture positions (column 5, lines 50-57), where the object includes common surface features and a control target arranged with respect to the object to provide control features (column 4, lines 35-40);

b) measuring the control features from the images of the control target included with the images of the object (column 4, lines 38-50);

c) analytically generating a 3-dimensional model of the object by photogrammetrically aligning the measurements of the control features, thereby providing a photogrammetrically aligned 3-dimensional model of the object while reducing image errors due to the variable orientations of the capture positions (column 4, lines 40-45 and column 5, lines 35-50, reducing the image errors due to the variable orientations are interpreted as the multiple x-ray scaling factors determined for multiple teeth), and

(d) adjusting the photogrammetrically aligned 3-dimensional model of the object by aligning the common features of the model to like features on an image of the object, thereby producing an aligned dental model from the series of images (column 5, lines 50-65).

With regard to claim 2, Sachdeva discloses the method as claimed in claim 1 wherein step (b) further includes the step of measuring the common features from the series of images of the object (column 5, lines 59-67). Here the common features are interpreted as the physical attributes on which reference points, which are measured, are to be placed.

With regard to claim 3, Sachdeva discloses the method as claimed in claim 1 wherein step (c) comprises the steps of:

performing a photogrammetric adjustment (column 4, lines 40-46); and

refining the photogrammetric adjustment by photogrammetrically projecting a 3-dimensional model of the target, determining misalignment of the control features and correcting the misalignment, thereby producing the photogrammetrically aligned 3-dimensional model of the object (column 4, lines 46-63 and column 5, lines 35-49, column 6, lines 52-67, column 8, lines 7-12). Here the first photogrammetric adjustment is interpreted as the scaling and the refinement is interpreted as the adjustment in the 3-D coordinate space pictured in figures 8 and 9.

With regard to claim 4, Sachdeva discloses the method as claimed in claim 1 wherein step (d) comprises the steps of:

determining misalignment of the common features in the photogrammetrically aligned 3-dimensional model relative to the images of the object by photogrammetrically projecting the model onto an image of the object (Fig. 9, element 100 and Fig. 8); and

applying a 3-dimensional morphing algorithm to correct for the misalignment (Fig.

8, element 82). Here Sachdeva discloses how the imaged reference points are used to

determine misalignment, rotation, etc. of a tooth.

With regard to claim 7, Sachdeva discloses the method as claimed in claim 1

wherein the intra-oral object is one or more teeth (Figs. 2 and 3).

With regard to claim 8, Sachdeva discloses the method as claimed in claim 7

wherein the control target is positioned around said one or more teeth (Figs. 2 and 3).

With regard to claim 9, Sachdeva discloses a system for creating a dental model

from a series of images of an intra-oral object, said system comprising:

a camera for capturing a series of images of an intra-oral object from a plurality

of capture positions (column 5, lines 50-57), where the object includes common surface

features and a control target arranged with respect to the object to provide control

features (Figs. 2 and 3);

photogrammetric means for measuring the control features from the images of

the control target included with the images of the object (column 4, lines 37-54);

a digital processor including instructions for (a) analytically generating a 3-

dimensional model of the object by photogrammetrically aligning the measurements of

the control features, thereby providing a photogrammetrically aligned 3-dimensional

model of the object while reducing image errors due to the variable orientations of the

capture positions (column 4, lines 37-54 and column 5, lines 35-49); and (b) adjusting

the photogrammetrically aligned 3-dimensional model of the object by aligning the

common features of the model to like features on an image of the object, thereby

producing an aligned dental model from the series of images (column 5, lines 50-57).

With regard to claim 10, Sachdeva discloses the system as claimed in claim 9

wherein said photogrammetric means further measures the common features from the

series of images of the object (column 4, lines 35-40 and column 5, lines 50-57).

With regard to claim 11, Sachdeva discloses the system as claimed in claim 9

wherein said digital processor further includes instructions for performing a

photogrammetric adjustment and refining the photogrammetric adjustment by

photogrammetrically projecting a 3-dimensional model of the image, determining

misalignment of the control features and correcting the misalignment, thereby producing

the photogrammetrically aligned 3-dimensional model of the object (column 4, lines 46-

63 and column 5, lines 35-49, column 6, lines 52-67, column 8, lines 7-12). Here the

first photogrammetric adjustment is interpreted as the scaling and the refinement is

interpreted as the adjustment in the 3-D coordinate space pictured in figures 8 and 9.

With regard to claim 12, Sachdeva discloses the system as claimed in claim 9

wherein said digital processor further includes instructions for determining misalignment

of the common features in the photogrammetrically aligned 3-dimensional model

relative to the images of the object by photogrammetrically projecting the model onto an image of the object and applying a 3-dimensional morphing algorithm to correct for the misalignment (Fig. 9, element 100 and Fig. 8, element 82).

With regard to claim 14, Sachdeva discloses the system as claimed in claim 9 wherein the intra-oral object is one or more teeth (Fig. 2).

With regard to claim 15, Sachdeva discloses the system as claimed in claim 14 wherein the control target is positioned around said one or more teeth (Fig. 2).

With regard to claim 16, Sachdeva discloses a method for creating a dental model from a series of images of one or more teeth, said method comprising the steps of:

(a) capturing a series of images of said one or more teeth from a plurality of capture positions (column 5, lines 50-55), where said one or more teeth include cusp and valley surface features (Figs. 4 and 5) describing their natural topographic surfaces and a rigid control target resting on said one or more teeth so as to provide control features (Figs. 2 and 3 and column 4, lines 35-45);

(b) measuring the control features from the images of the control target included with the images of said one or more teeth (column 4, lines 35-45);

(c) analytically generating a 3-dimensional model of said one or more teeth by

photogrammetrically aligning the measurement of the control features, thereby providing

a photogrammetrically aligned 3-dimensional model of said one or more teeth while

reducing image errors due to the variable orientations of the capture positions (column

4, lines 37-54 and column 5, lines 35-49); and

(d) adjusting the photogrammetrically aligned 3-dimensional model of said one or

more teeth by aligning the cusp and valley surface features of the model to like features

on an image of said one or more teeth, thereby producing an aligned dental model from

the series of images (column 5, lines 50-57 and Figs.4 and 5). It is understood that all

the features of the teeth including cusp and valley surfaces will line up when accurately

matched.

## Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set
> forth in section 102 of this title, if the differences between the subject matter sought to be patented and
> the prior art are such that the subject matter as a whole would have been obvious at the time the
> invention was made to a person having ordinary skill in the art to which said subject matter pertains.
> Patentability shall not be negatived by the manner in which the invention was made.

Claims 5, 6 and 13 rejected under 35 U.S.C. 103(a) as being unpatentable over

U.S. Patent 6,512,994 to Sachdeva in view of U.S. Patent 6,648,640 to Rubbert et al.

With regard to claim 5, Sachdeva discloses the method as claimed in claim 1, but does not explicitly disclose further comprising the step of using the aligned dental model to generate a dental restorative piece for the intra-oral object. Rubbert discloses a similar invention to that of Sachdeva in which 3-D model is generated with a CAD system (column 5, lines 60-63 and column 71) and is used to supply a 3-D model to a stereo lithography system that manufactures a plastic model of teeth (column 72, lines 26-29). Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to use the 3-D model generated by Sachdeva in combination with the plastic teeth manufacturing taught by Rubbert in order to generate a 3-D schematic for a replacement plastic tooth.

With regard to claim 6, Sachdeva discloses the method as claimed in claim 1, but does not disclose further comprising the steps of providing a database of generic 3-dimensional models and utilizing a selected one of the generic models in step (d) in the alignment of the common features of the <u>photogrammetrically aligned 3-dimensional</u> model to like features on the image of the object. Sachdeva discloses finding alignment or reference points that do not change throughout the course of treatment (column 6, lines 1-22). Rubbert discloses three dimensional virtual template tooth objects (column 50, lines 38-40) for such purposes as in providing replacement teeth as they fit in a 3-D model. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to provide a data base of generic 3-D models in order to manipulate the models to see if a replacement tooth might fit in a patients mouth.

With regard to claim 13, the discussion of claim 5 applies.

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,512,994 to Sachdeva.

With regard to claim 17, Sachdeva discloses the method as claimed in claim 16 wherein the control features comprise vertices (column 8, lines 8-12) and discloses a rigid target (Fig. 2), but does not disclose wherein the rigid control target has a saddle form resting over said one or more teeth and the control features comprise vertices in the saddle form. However it would have been obvious to one of ordinary skill in the art at the time of invention to place any kind of rigid target on or around or on top of the tooth as a matter of design choice to give optimum or most appropriate scanning results.

### Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wes Tucker whose telephone number is 571-272-7427. The examiner can normally be reached on 9AM-5PM.
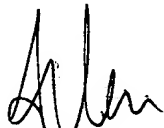
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on 571-272-7414. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free).

Wes Tucker

4-26-05

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